**3GPP TSG-CT WG4 Meeting #98eC4-203xyz**

**E-Meeting, 02nd – 12th June 2020**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **29.510** | **CR** | **0abc** | **rev** | **-** | **Current version:** | **15.6.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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|  | | | | | | | | | | |
| ***Title:*** | NRF Notifications | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson, Nokia, Nokia Shanghai Bell, Cisco | | | | | | | | | |
| ***Source to TSG:*** | CT4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5GS\_Ph1-CT | | | | |  | ***Date:*** | | | 2020-04-30 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-15 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | There may be a mismatch between the NF Profile data received in a discovery response and the subsequent notifications sent by NRF to subscribing NFs, when such NF Profile is changed.  This is particularly harmful when those changes affect an attribute of type array, since the array indexes may differ between those received in the discovery response, and those received in the notification request from NRF.  This issue also affects the creation of subscriptions, when the "notifCondition" attribute may be used to refer to specific elements of an array (e.g. a certain service in the nfServices array). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | - For those attributes in the NFProfile that are of type array, and are subject to mismatches between data received in the discovery response and the data received in the notification request, the NRF shall only send profile update notifications by replacing entire arrays, and not sending changes of individual array elements.  - When receiving a subscription request that includes "notifCondition" attribute (i.e. a list of monitored/unmonitored attributes) referencing a specific array element (by its array index) it shall apply the condition to all elements of the same array. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The NF profile data kept by NF consumers of the NRF may get corrupted, if the set of changes received in a notification are applied to the wrong array index. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.1.2.2.3, 6.1.6.2.2, 6.1.6.2.16, 6.1.6.2.17, A.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | This CR introduces backwards compatible corrections, with impacts on the following APIs:  - TS29510\_Nnrf\_NFManagement.yaml | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* First Change \* \* \* \*

##### 6.1.2.2.3 Accept-Encoding

The NRF should support gzip coding (see IETF RFC 1952 [30]) in HTTP requests and responses and indicate so in the Accept-Encoding header, as described in clause 6.9 of 3GPP TS 29.500 [4].

NF Service Consumers of the NFManagement API should support gzip coding in HTTP requests and responses and they should support gzip coding in the reception of notification requests sent by the NRF.

\* \* \* Next Change \* \* \* \*

##### 6.1.6.2.2 Type: NFProfile

Table 6.1.6.2.2-1: Definition of type NFProfile

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| nfInstanceId | NfInstanceId | M | 1 | Unique identity of the NF Instance. |
| nfType | NFType | M | 1 | Type of Network Function |
| nfStatus | NFStatus | M | 1 | Status of the NF Instance (NOTE 5) |
| heartBeatTimer | integer | C | 0..1 | Time in seconds expected between 2 consecutive heart-beat messages from an NF Instance to the NRF.  It may be included in the registration request. When present in the request it shall contain the heartbeat time proposed by the NF service consumer.  It shall be included in responses from NRF to registration requests (PUT) or in NF profile updates (PUT or PATCH). If the proposed heartbeat time is acceptable by the NRF based on the local configuration, it shall use the same value as in the registration request; otherwise the NRF shall override the value using a preconfigured value. |
| plmnList | array(PlmnId) | C | 1..N | PLMN(s) of the Network Function (NOTE 7).  This IE shall be present if this information is available for the NF.  If not provided, PLMN ID(s) of the PLMN of the NRF are assumed for the NF. |
| sNssais | array(Snssai) | O | 1..N | S-NSSAIs of the Network Function.  If not provided, the NF can serve any S-NSSAI.  When present this IE represents the list of S-NSSAIs supported in all the PLMNs listed in the plmnList IE.  (NOTE YY) |
| perPlmnSnssaiList | array(PlmnSnssai) | O | 1..N | This IE may be included when the list of S-NSSAIs supported by the NF for each PLMN it is supporting is different. When present, this IE shall include the S-NSSAIs supported by the Network Function for each PLMN supported by the Network Function. When present, this IE shall override sNssais IE.  (NOTE 9) (NOTE YY) |
| nsiList | array(string) | O | 1..N | NSI identities of the Network Function.  If not provided, the NF can serve any NSI. |
| fqdn | Fqdn | C | 0..1 | FQDN of the Network Function (NOTE 1) (NOTE 2). For AMF, the FQDN registered with the NRF shall be that of the AMF Name (see 3GPP 23.003 [12] clause 28.3.2.5). |
| interPlmnFqdn | Fqdn | C | 0..1 | If the NF needs to be discoverable by other NFs in a different PLMN, then an FQDN that is used for inter-PLMN routing as specified in 3GPP 23.003 [12] shall be registered with the NRF (NOTE 8).  A change of this attribute shall result in triggering a "NF\_PROFILE\_CHANGED" notification from NRF towards subscribing NFs located in a different PLMN, but the new value shall be notified as a change of the "fqdn" attribute. |
| ipv4Addresses | array(Ipv4Addr) | C | 1..N | IPv4 address(es) of the Network Function (NOTE 1) (NOTE 2) |
| ipv6Addresses | array(Ipv6Addr) | C | 1..N | IPv6 address(es) of the Network Function (NOTE 1) (NOTE 2) |
| allowedPlmns | array(PlmnId) | O | 1..N | PLMNs allowed to access the NF instance.  If not provided, any PLMN is allowed to access the NF.  A change of this attribute shall not trigger a "NF\_PROFILE\_CHANGED" notification from NRF, and this attribute shall not be included in profile change notifications to subscribed NFs. |
| allowedNfTypes | array(NFType) | O | 1..N | Type of the NFs allowed to access the NF instance.  If not provided, any NF type is allowed to access the NF.  A change of this attribute shall not trigger a "NF\_PROFILE\_CHANGED" notification from NRF, and this attribute shall not be included in profile change notifications to subscribed NFs. |
| allowedNfDomains | array(string) | O | 1..N | Pattern (regular expression according to the ECMA-262 dialect [8]) representing the NF domain names allowed to access the NF instance.  If not provided, any NF domain is allowed to access the NF.  A change of this attribute shall not trigger a "NF\_PROFILE\_CHANGED" notification from NRF, and this attribute shall not be included in profile change notifications to subscribed NFs. |
| allowedNssais | array(Snssai) | O | 1..N | S-NSSAI of the allowed slices to access the NF instance.  If not provided, any slice is allowed to access the NF.  A change of this attribute shall not trigger a "NF\_PROFILE\_CHANGED" notification from NRF, and this attribute shall not be included in profile change notifications to subscribed NFs. |
| priority | integer | O | 0..1 | Priority (relative to other NFs of the same type) in the range of 0-65535, to be used for NF selection; lower values indicate a higher priority. If priority is also present in the nfServiceList parameters, those will have precedence over this value. (NOTE 4).  The NRF may overwrite the received priority value when exposing an NFProfile with the Nnrf\_NFDiscovery service. |
| capacity | integer | O | 0..1 | Static capacity information in the range of 0-65535, expressed as a weight relative to other NF instances of the same type; if capacity is also present in the nfServiceList parameters, those will have precedence over this value. (NOTE 4). |
| load | integer | O | 0..1 | Dynamic load information, ranged from 0 to 100, indicates the current load percentage of the NF. |
| locality | string | O | 0..1 | Operator defined information about the location of the NF instance (e.g. geographic location, data center) (NOTE 3) |
| udrInfo | UdrInfo | O | 0..1 | Specific data for the UDR (ranges of SUPI, group ID …) |
| udmInfo | UdmInfo | O | 0..1 | Specific data for the UDM (ranges of SUPI, group ID…) |
| ausfInfo | AusfInfo | O | 0..1 | Specific data for the AUSF (ranges of SUPI, group ID…) |
| amfInfo | AmfInfo | O | 0..1 | Specific data for the AMF (AMF Set ID, …) |
| smfInfo | SmfInfo | O | 0..1 | Specific data for the SMF (DNN's, …) |
| upfInfo | UpfInfo | O | 0..1 | Specific data for the UPF (S-NSSAI, DNN, SMF serving area, interface…) |
| pcfInfo | PcfInfo | O | 0..1 | Specific data for the PCF |
| bsfInfo | BsfInfo | O | 0..1 | Specific data for the BSF |
| chfInfo | ChfInfo | O | 0..1 | Specific data for the CHF |
| nrfInfo | NrfInfo | O | 0..1 | Specific data for the NRF |
| customInfo | object | O | 0..1 | Specific data for custom Network Functions |
| recoveryTime | DateTime | O | 0..1 | Timestamp when the NF was (re)started (NOTE 5) (NOTE 6) |
| nfServicePersistence | boolean | O | 0..1 | If present, and set to true, it indicates that the different service instances of a same NF Service in this NF instance, supporting a same API version, are capable to persist their resource state in shared storage and therefore these resources are available after a new NF service instance supporting the same API version is selected by a NF Service Consumer (see 3GPP 23.527 [27]).  Otherwise, it indicates that the NF Service Instances of a same NF Service are not capable to share resource state inside the NF Instance. |
| nfServices | array(NFService) | O | 1..N | List of NF Service Instances. It shall include the services produced by the NF that can be discovered by other NFs, if any.  (NOTE YY) |
| nfProfileChangesSupportInd | boolean | O | 0..1 | NF Profile Changes Support Indicator.  See Annex B.  This IE may be present in the NFRegister or NFUpdate (NF Profile Complete Replacement) request and shall be absent in the response.  true: the NF Service Consumer supports receiving NF Profile Changes in the response.  false (default): the NF Service Consumer does not support receiving NF Profile Changes in the response.  Write-Only: true |
| nfProfileChangesInd | boolean | O | 0..1 | NF Profile Changes Indicator.  See Annex B.  This IE shall be absent in the request to the NRF and may be included by the NRF in NFRegister or NFUpdate (NF Profile Complete Replacement) response.  true: the NF Profile contains NF Profile changes.  false (default): complete NF Profile.  Read-Only: true |
| defaultNotificationSubscriptions | array(DefaultNotificationSubscription) | O | 1..N | Notification endpoints for different notification types.  (NOTE 10) |
| NOTE 1: At least one of the addressing parameters (fqdn, ipv4address or ipv6adress) shall be included in the NF Profile. If the NF supports the NF services with "https" URI scheme (i.e use of TLS is mandatory), then the FQDN shall be provided in the NF Profile or the NF Service profile (see clause 6.1.6.2.3). See NOTE 1 of Table 6.1.6.2.3-1 for the use of these parameters. If multiple ipv4 addresses and/or ipv6 addresses are included in the NF Profile, the NF Service Consumer of the discovery service shall select one of these addresses randomly, unless operator defined local policy of IP address selection, in order to avoid overload for a specific ipv4 address and/or ipv6 address.  NOTE 2: If the type of Network Function is UPF, the addressing information is for the UPF N4 interface.  NOTE 3: A requester NF may use this information to select a NF instance (e.g. a NF instance preferably located in the same data center).  NOTE 4: The capacity and priority parameters, if present, are used for NF selection and load balancing. The priority and capacity attributes shall be used for NF selection in the same way that priority and weight are used for server selection as defined in IETF RFC 2782 [23].  NOTE 5: The NRF shall notify NFs subscribed to receiving notifications of changes of the NF profile, if the NF recoveryTime or the nfStatus is changed. See clause 6.2 of 3GPP 23.527 [27].  NOTE 6: A requester NF may consider that all the resources created in the NF before the NF recovery time have been lost. This may be used to detect a restart of a NF and to trigger appropriate actions, e.g. release local resources. See clause 6.2 of 3GPP 23.527 [27].  NOTE 7: A NF may register multiple PLMN IDs in its profile within a PLMN comprising multiple PLMN IDs. If so, all the attributes of the NF Profile shall apply to each PLMN ID registered in the plmnList. As an exception, attributes including a PLMN ID, e.g. IMSI-based SUPI ranges, TAIs and GUAMIs, are specific to one PLMN ID and the NF may register in its profile multiple occurrences of such attributes for different PLMN IDs (e.g. the UDM may register in its profile SUPI ranges for different PLMN IDs).  NOTE 8: Other NFs are in a different PLMN if they belong to none of the PLMN ID(s) configured for the PLMN of the NRF.  NOTE 9: This is for the use case where an NF (e.g. AMF) supports multiple PLMNs and the slices supported in each PLMN are different. See clause 9.2.6.2 of 3GPP TS 38.413 [29].  NOTE 10: If notification endpoints are present both in the profile of the NF instance (NFProfile) and in some of its NF Services (NFService) for a same notification type, the notification endpoint(s) of the NF Services shall be used for this notification type.  NOTE YY: If a change of this attribute triggers a notification from NRF of type "NF\_PROFILE\_CHANGED", and the changed data is sent as a set of incremental changes of the NFProfile (i.e. as a list of "ChangeItem", see clause 6.1.6.2.17), those changes must be sent as a complete replacement of the entire array attribute, and not as individual changes of specific array elements). | | | | |

\* \* \* Next Change \* \* \* \*

##### 6.1.6.2.16 Type: SubscriptionData

Table 6.1.6.2.16-1: Definition of type SubscriptionData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| nfStatusNotificationUri | Uri | M | 1 | Callback URI where the NF Service Consumer will receive the notifications from NRF. |
| subscrCond | SubscrCond | O | 0..1 | If present, this attributed shall contain the conditions identifying the set of NF Instances whose status is requested to be monitored. If this attribute is not present, it means that the NF Service Consumer requests a subscription to all NFs in the NRF (NOTE 1). |
| subscriptionId | string | C | 0..1 | Subscription ID for the newly created resource. This parameter shall be absent in the request to the NRF and shall be included by NRF in the response to the subscription creation request.  Read-Only: true |
| validityTime | DateTime | C | 0..1 | Time instant after which the subscription becomes invalid. This parameter may be sent by the client, as a hint to the server, but it shall be always sent back by the server (regardless of the presence of the attribute in the request) in the response to the subscription creation request. |
| reqNotifEvents | array(NotificationEventType) | O | 1..N | If present, this attribute shall contain the list of event types that the NF Service Consumer is interested in receiving.  If this attribute is not present, it means that notifications for all event types are requested. |
| reqNfType | NFType | O | 0..1 | If included, this IE shall contain the NF type of the NF Service Consumer that is requesting the creation of the subscription. The NRF shall use it for authorizing the request, in the same way as the "requester-nf-type" is used in the NF Discovery service (see Table 6.2.3.2.3.1-1).  When the subscription is for a set of NF Instances, the subscription may be accepted by NRF, but it shall only generate notifications from NF Instances whose authorization parameters allow the NF Service Consumer to access their services (NOTE 2). |
| reqNfFqdn | Fqdn | O | 0..1 | If included, this IE shall contain the FQDN of the NF Service Consumer that is requesting the creation of the subscription. The NRF shall use it for authorizing the request, in the same way as the "requester-nf-instance-fqdn" is used in the NF Discovery service (see Table 6.2.3.2.3.1-1).  When the subscription is for a set of NF Instances, the subscription may be accepted by NRF, but it shall only generate notifications from NF Instances whose authorization parameters allow the NF Service Consumer to access their services (NOTE 2). |
| reqSnssais | array(Snssai) | O | 0..1 | If included, this IE shall contain the list of S-NSSAIs of the NF Service Consumer that is requesting the creation of the subscription. The NRF shall use it for authorizing the request, in the same way as the "requester-snssais" is used in the NF Discovery service (see Table 6.2.3.2.3.1-1).  When the subscription is for a set of NF Instances, the subscription may be accepted by NRF, but it shall only generate notifications from NF Instances whose authorization parameters allow the NF Service Consumer to access their services (NOTE 2). |
| plmnId | PlmnId | O | 0..1 | If present, this attribute contains the target PLMN ID of the NF Instance(s) whose status is requested to be monitored. |
| notifCondition | NotifCondition | O | 0..1 | If present, this attribute contains the conditions that trigger a notification from NRF; this attribute shall only be present if the NF Service Consumer has subscribed to changes on the NF Profile (i.e., reqNotifEvents contains the value "NF\_PROFILE\_CHANGED", or reqNotifEvents attribute is absent).  If this attribute is absent, it means that the NF Service Consumer does not indicate any restriction, or condition, on which attributes of the NF Profile shall trigger a notification from NRF.  (NOTE X). |
| NOTE 1: The "subscription to all NFs" may be quite demanding in terms of resources in NRF and also in terms of network traffic of the resulting notifications, so it should be authorized by NRF under very strict policies (e.g. only to a specific requesting NF, as indicated by reqNfType and reqNfFqdn attributes).  NOTE 2: The authorization parameters in NF Profile are those used by NRF to determine whether a given NF Instance / NF Service Instance can be discovered by an NF Service Consumer in order to consume its offered services (e.g. "allowedNfTypes", "allowedNfDomains", etc.).  NOTE X: If the attributes to be monitored or excluded from monitoring, included as part of the "notifCondition" attribute, refer to a specific element of an array (e.g. they refer to a specifc array index of the "nfServices" attribute of the NFProfile), the NRF shall apply the same condition to all elements of the same array. | | | | |

\* \* \* Next Change \* \* \* \*

##### 6.1.6.2.17 Type: NotificationData

Table 6.1.6.2.17-1: Definition of type NotificationData

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description |
| event | NotificationEventType | M | 1 | Notification type. It shall take the values "NF\_REGISTERED", "NF\_DEREGISTERED" OR "NF\_PROFILE\_CHANGED". |
| nfInstanceUri | Uri | M | 1 | Uri of the NF Instance (see clause 6.1.3.3.2) associated to the notification event. |
| nfProfile | NFProfile | C | 0..1 | New NF Profile or Updated NF Profile; it shall be present when the notification type is "NF\_REGISTERED" or "NF\_PROFILE\_CHANGED". |
| profileChanges | array(ChangeItem) | C | 1..N | List of changes on the profile of the NF Instance associated to the notification event; it may be present when the notification type is "NF\_PROFILE\_CHANGED" (see NOTE 1, NOTE X). |
| NOTE 1: If "event" attribute takes the value "NF\_PROFILE\_CHANGED", then either "nfProfile" or "profileChanges" attributes shall be present, but not both.  NOTE X: For those array attributes explicitly indicated in the NFProfile data type definition (see clause 6.1.6.2.2), the NRF shall notify about NF Profile changes affecting those attributes as a complete replacement of the whole array (i.e. it shall not notify about changes of individual array elements). | | | | |

EXAMPLE: Notification payload sent from NRF when an NF Instance has changed its profile by updating the value of the "recoveryTime" attribute of its NF Profile, and updated any attribute of any of its NF Service Instances:

{

"event": "NF\_PROFILE\_CHANGED",

"nfInstanceUri": ".../nf-instances/4947a69a-f61b-4bc1-b9da-47c9c5d14b64",

"profileChanges": [

{

"op": "REPLACE",

"path": "/recoveryTime",

"newValue": "2018-12-30T23:20:50Z"

},

{

"op": "REPLACE",

"path": "/nfServices",

"newValue": [ ...new array content... ]

}

]

}

\* \* \* Next Change \* \* \* \*

## A.2 Nnrf\_NFManagement API

***(… text not shown for clarity …)***

callbacks:

onNFStatusEvent:

'{$request.body#/nfStatusNotificationUri}':

post:

parameters:

- name: Content-Encoding

in: header

description: Content-Encoding, described in IETF RFC 7231

schema:

type: string

requestBody:

description: Notification Payload

content:

application/json:

schema:

$ref: '#/components/schemas/NotificationData'

responses:

'204':

description: Expected response to a successful callback processing

headers:

Accept-Encoding:

description: Accept-Encoding, described in IETF RFC 7694

schema:

type: string

***(… text not shown for clarity …)***

\* \* \* End of Changes \* \* \* \*